

# Kitchen Math Session 2: Weights and Measures



## PARTICIPANT BOOK





For Slide #27

	Breakfast Meal Pattern			Lunch Meal Pattern		
	Grades K-5 <sup>a</sup>	Grades 6-8 <sup>a</sup>	Grades 9-12 <sup>a</sup>	Grades K-5	Grades 6-8	Grades 9-12
<b>Meal Pattern</b>	<b>Amount of Food <sup>b</sup> Per Week (Minimum Per Day)</b>					
Fruits (cups) <sup>c,d</sup>	5 (1) <sup>e</sup>	5 (1) <sup>e</sup>	5 (1) <sup>e</sup>	2½ (½)	2½ (½)	5 (1)
Vegetables (cups) <sup>c,d</sup>	0	0	0	¾ (¾)	¾ (¾)	5 (1)
Dark green <sup>f</sup>	0	0	0	½	½	½
Red/Orange <sup>f</sup>	0	0	0	¾	¾	1 ¼
Beans/Peas (Legumes) <sup>f</sup>	0	0	0	½	½	½
Starchy <sup>f</sup>	0	0	0	½	½	½
Other <sup>f,g</sup>	0	0	0	½	½	¾
Additional Veg to Reach Total <sup>h</sup>	0	0	0	1	1	1½
Grains (oz eq) <sup>i</sup>	7(1) <sup>j</sup>	8 (1) <sup>j</sup>	9 (1) <sup>j</sup>	8 (1)	8 (1)	10 (2)
Meats/Meat Alternates (oz eq)	0 <sup>k</sup>	0 <sup>k</sup>	0 <sup>k</sup>	8 (1)	9 (1)	10 (2)
Fluid milk (cups) <sup>l</sup>	5 (1)	5 (1)	5 (1)	5 (1)	5 (1)	5 (1)
<b>Other Specifications: Daily Amount Based on the Average for a 5-Day Week</b>						
Min-max calories (kcal) <sup>m,n,o</sup>	350-500	400-550	450-600	550-650	600-700	750-850
Saturated fat (% of total calories) <sup>n,o</sup>	< 10	< 10	< 10	< 10	< 10	< 10
2014-15 Sodium (mg) <sup>n, p</sup>	< 540	< 600	< 640	< 1230	< 1360	< 1420
2017-18 Sodium (mg) <sup>n, p</sup>	< 485	< 535	< 570	< 935	< 1035	< 1080
2022-23 Sodium (mg) <sup>n, p</sup>	< 430	< 470	< 500	< 640	< 710	< 740
Trans fat <sup>n,o</sup>	Nutrition label or manufacturer specifications must indicate zero grams of trans fat per serving.					

Final Rule Nutrition Standards in the National School Lunch and School Breakfast Programs – Jan. 2012

<sup>a</sup> In the SBP, the above age-grade groups are required beginning July 1, 2013 (SY 2013-14).

<sup>b</sup> Food items included in each food group and subgroup and amount equivalents. Minimum creditable serving is ¼ cup.

<sup>c</sup> One quarter-cup of dried fruit counts as ½ cup of fruit; 1 cup of leafy greens counts as ½ cup of vegetables. No more than half of the fruit or vegetable offerings may be in the form of juice. All juice must be 100% full-strength.

<sup>d</sup> For breakfast, vegetables may be substituted for fruits, but the first two cups per week of any such substitution must be from the dark green, red/orange, beans and peas (legumes) or “Other vegetables” subgroups as defined in §210.10(c)(2)(iii).

<sup>e</sup> The fruit quantity requirement for the SBP (5 cups/week and a minimum of 1 cup/day) is effective July 1, 2014 (SY 2014-2015).

<sup>f</sup> Larger amounts of these vegetables may be served.

<sup>g</sup> This category consists of “Other vegetables” as defined in §210.10(c)(2)(iii)(E). For the purposes of the NSLP, “Other vegetables” requirement may be met with any additional amounts from the dark green, red/orange, and beans/peas (legumes) vegetable subgroups as defined in §210.10(c)(2)(iii).

<sup>h</sup> Any vegetable subgroup may be offered to meet the total weekly vegetable requirement.

<sup>i</sup> All grains must be whole grain-rich in both the NSLP and the SBP beginning July 1, 2014 (SY 2014-15).

<sup>j</sup> In the SBP, the grain ranges must be offered beginning July 1, 2013 (SY 2013-2014).

<sup>k</sup> There is no separate meat/meat alternate component in the SBP. Beginning July 1, 2013 (SY 2013-2014), schools may substitute 1 oz. eq. of meat/meat alternate for 1 oz. eq. of grains after the minimum daily grains requirement is met.

<sup>l</sup> Fluid milk must be low-fat (1 percent milk fat or less, unflavored) or fat-free (unflavored or flavored).

<sup>m</sup> The average daily amount of calories for a 5-day school week must be within the range (at least the minimum and no more than the maximum values).

<sup>n</sup> Discretionary sources of calories (solid fats and added sugars) may be added to the meal pattern if within the specifications for calories, saturated fat, trans fat, and sodium. Foods of minimal nutritional value and fluid milk with fat content greater than 1 percent milk fat are not allowed.

<sup>o</sup> In the SBP, calories and trans fat specifications take effect beginning July 1, 2013 (SY 2013-2014).

<sup>p</sup> Final sodium specifications are to be reached by SY 2022-2023 or July 1, 2022. Intermediate sodium specifications are established for SY 2014-2015 and 2017-2018. See required intermediate specifications in § 210.10(f)(3) for lunches and § 220.8(f)(3) for breakfast

## **Weights and Measures Activity**

**Station 1: Understanding Ounces**

**Station 2: Sugar**

**Station 3: Flour**

**Station 4: Water**

**Station 5: Ground Beef**

**Station 6: Lettuce**

**Optional Station 7: Weighing Multiple Ingredients**

## Station 1:

### 1. How are volume ounces different than weight ounces?

- a. Tare a 1 cup (8 fluid ounces) volume container on the digital scale
- b. Add marshmallows to the full line.
- c. Record weight in ounces \_\_\_\_\_ oz
- d. Empty container and re-tare
- e. Add dry beans to the full line
- f. Record weight in ounces \_\_\_\_\_ oz

#### Discussion Questions:

Does 8 fl. oz of marshmallows weigh 8 oz?

Does 8 fl. oz of dry bean weigh 8 oz?

Do the marshmallows and beans weigh the same amount for the same volume?

Why or why not?

Notes:

## Station 2:

### 2. Does it make a difference to use the largest reasonable measuring tool?

- a. Tare a container on the digital scale
- b. Measure  $1\frac{1}{2}$  cups of sugar using the  $1\frac{1}{2}$  cup measure
- c. Record weight in grams \_\_\_\_\_g
- d. Remove sugar and re-tare container
- e. Measure  $1\frac{1}{2}$  cups of sugar using a  $\frac{1}{2}$  cup measure 3 times. ( $3/2 = 1\frac{1}{2}$ )
- f. Record weight in grams \_\_\_\_\_g
- g. Remove sugar and re-tare container
- h. Measure  $1\frac{1}{2}$  cups of sugar using a  $\frac{1}{4}$  cup measure 6 times ( $6/4 = 1\frac{1}{2}$ )
- i. Record weight in grams. \_\_\_\_\_g

#### Discussion Questions:

Did the using different measuring tools result in different weights? Why or why not?

Which measuring technique was the fastest?

Which measuring technique requires the least calculation?

Notes:

## Station 3:

### 3. Does technique matter when measuring flour?

- a. Tare a plastic container on the digital scale
- b. Stir the flour and spoon it into a 2 cup measure. Level off the top.
- c. Record weight in grams \_\_\_\_\_g
- d. Remove flour and re-tare scale with empty container
- e. Scoop the flour into a 2 cup measure. Tap the measuring container on the table 4-5 times to settle the flour. Add additional flour to fill and level off the top
- f. Record weight in grams. \_\_\_\_\_g

#### Discussion Questions:

Did the two different measuring techniques result in different weights? Why or why not?

Based on this activity, why do you think bakers prefer weight to volume when measuring flour?

What technique difference is used when measuring brown sugar verses measuring flour?

Notes:

## **Station 4:**

### **4. Why is a fluid measure a better tool for liquids than a dry measure?**

- a. On a tray with a bowl
  - i. measure 1 cup of water in a 1 cup liquid measure
  - ii. measure 1 cup of water in a 1 cup dry measure
  - iii. Pour both measures into the bowl or container

#### **Discussion Questions:**

How easy was it to get a level liquid measure in a dry measure?

Which measuring tool, liquid or dry, was easier to maneuver to the bowl without spills?

Notes:



## Station 5:

### 5. Is one pound of meat raw the same as one pound of meat cooked?

- a. Tare the digital scale with an empty plastic bag (similar to that containing the meat)
- b. Weigh the bag with raw ground beef
  - i. Record weight in ounces \_\_\_\_\_oz
- c. Weigh the bag with ground beef that has been cooked but not drained of fat. (This meat weighed exactly the same as the raw meat before cooking.)
  - i. Record weight in ounces \_\_\_\_\_oz

#### Discussion Questions:

Was there a difference in weight? Why?

When the cooked meat was drained of fat, what would change?

This meat was 85/15 (85% meat, 15% fat), would you expect a different result with ground beef that was 70/30? Why or why not?

In NSLP, the meat requirement is based on **cooked** weight, so if I had to feed 100 students a 2 ounce cooked portion, could I use 200 ounces (12.5#) of raw ground beef? What resource would be helpful in determining how much raw ground beef to cook?

Notes:

## Station 6:

### 6. Is there a quick way to convert weight to volume?

Imagine you have a five pound bag of chopped romaine lettuce for lunch service. Each student needs 1 cup of lettuce

- a. How would you determine how many servings you have in 5 #?
- b. Do you have all the information that you need? If not, where can you get it? \_\_\_\_\_
- c. Tare the scale and weigh 1 cup of lettuce
- d. Record the weight in grams \_\_\_\_\_gr
- e. Empty the measure and have another person in your group weigh 1 cup of lettuce
- f. Record the weight in grams \_\_\_\_\_gr

#### Discussion Questions:

How comfortable do you feel with the weight you got on the lettuce? Does it feel exact?

If you wanted to know how many cups of a vegetable are in one pound, what is a resource that you could check first?

If you were measuring the cups in 5# of lettuce, what size volume measure would you use? Why?

In your kitchen how do you determine the number of servings in a 5 # bag of salad mix?

Notes:

## Station 7:

### 7. How do you weigh multiple ingredients at one time?

- a. Tare the scale and container
- b. Weigh  $\frac{1}{2}$  lb of the first ingredient (flour) in the container
- c. Without removing container or first ingredient, re-tare the scale
- d. Add  $\frac{1}{4}$  cup of the 2<sup>nd</sup> ingredient (also flour for demonstration purposes)

#### Discussion Questions:

How comfortable were you with this technique? Have you done this before?  
Was it difficult?

Do you think it would speed up or slow down the process of baking from scratch?

Notes:

## **Kitchen Math**

### **Session 2: Weights and Measures**

#### **Resources**

## Rules for Measuring Ingredients

### Handout 6

#### Rules to follow when measuring dry ingredients

- Use standard measuring equipment.
- Use the largest appropriate standard measuring container to save time and to reduce error.  
Exception: To measure flour, do not use a container larger than 1 quart because flour packs easily.
- Spoon ingredient lightly into the measuring container. (If lumpy, sift before measuring.)  
Exception: Pack brown sugar firmly into the measuring container so it will take the shape of the container when emptied.
- Fill the measuring container to overflowing and level off with a straight-edged spatula.
- Avoid shaking or tapping measuring container.

#### Rules to follow when measuring liquid ingredients

- Use the largest appropriate standard measuring container.
- Place liquid measuring container on a flat surface.
- Pour liquid into the container until it reaches the desired level.
- Read at eye level when using a clear container. If a metal container is used, look inside the container as the liquid is filled to the desired level.

It is easier to weigh peanut butter and solid fat such as butter and shortening. When it is necessary to measure these ingredients, they should be pressed firmly into the measuring container and leveled off with a straight-edged spatula.



### Decimal Weight Equivalents

Ounces	Pounds	Ounces	Pounds
1 oz =	0.06 lb	16 oz =	1.00 lb
2 oz =	0.12 lb	32 oz =	2.00 lb
3 oz =	0.19 lb	35 oz =	2.19 lb
4 oz =	0.25 lb	48 oz =	3.00 lb
5 oz =	0.31 lb	64 oz =	4.00 lb
6 oz =	0.38 lb	71 oz =	4.44 lb
7 oz =	0.44 lb	80 oz =	5.00 lb
8 oz =	0.50 lb	96 oz =	6.00 lb
9 oz =	0.56 lb	106 oz =	6.63 lb
10 oz =	0.62 lb	112 oz =	7.00 lb
11 oz =	0.69 lb	128 oz =	8.00 lb
12 oz =	0.75 lb	141 oz =	8.82 lb
13 oz =	0.81 lb	144 oz =	9.00 lb
14 oz =	0.88 lb	160 oz =	10.00 lb
15 oz =	0.94 lb		

## Decimal Equivalents of Commonly Used Fractions

$1/8 = 0.125$	$1/3 = 0.333$	$2/3 = 0.666$
$1/4 = 0.250$	$1/2 = 0.500$	$3/4 = 0.750$
$3/8 = 0.375$	$5/8 = 0.625$	$7/8 = 0.875$

## Converting Decimal Equivalents to the Nearest Portion of a Cup for Fruits and Vegetables

If decimal equivalent is:	the recipe contributes:
0.125 - .249	$1/8$ cup
.250 - .374	$1/4$ cup
.375 - .499	$3/8$ cup
.500 - .624	$1/2$ cup
.625 - .749	$5/8$ cup
.750 - .874	$3/4$ cup
.875 - .999	$7/8$ cup
1.000 - 1.124	1 cup

**Metric Equivalents by Weight**

<i>Customary Unit (avoirdupois)</i>	<i>Metric Unit</i>
<i>Ounces (oz)</i>	<i>Grams (g)</i>
1 oz .....	28.35 g
4 oz .....	113.4 g
8 oz .....	226.8 g
16 oz .....	453.6g
<i>Pounds (lb)</i>	<i>Grams (g)</i>
1 lb .....	453.6 g
2 lb .....	907.2 g
<i>Pounds (lb)</i>	<i>Kilograms (kg)</i>
2.2 lb .....	1 kg (1000 g)

**Metric Equivalents by Volume**

<i>Customary Unit (fluid ounces)</i>	<i>Metric Unit</i>
1 cup (8 fl oz) .....	236.59 milliliters (mL)
1 quart (32 fl oz) .....	946.36 milliliters (mL)
1.5 quarts (48 fl oz) .....	1.42 liter (L)
33.818 fl oz.....	1.0 liter (L)



## A Guide to Metric Conversions

<i>To change</i>	<i>To</i>	<i>Multiply by</i>
ounces (oz)	grams (g)	28.35
pounds (lb)	grams (g)	453.6
pounds (lb)	kilograms (kg)	0.4536
teaspoons (tsp)	milliliters (mL)	4.93
tablespoons (Tbsp)	milliliters (mL)	14.79
fluid ounces (fl oz)	milliliters (mL)	29.57
cups (c)	liters (L)	0.236
pints (pt)	liters (L)	0.473
quarts (qt)	liters (L)	0.946
gallons (gal)	liters (L)	3.785

**Cup-cup, Pint. Pint-Pint, Quart. Quart-Quart-Quart-Quart, Gallon**

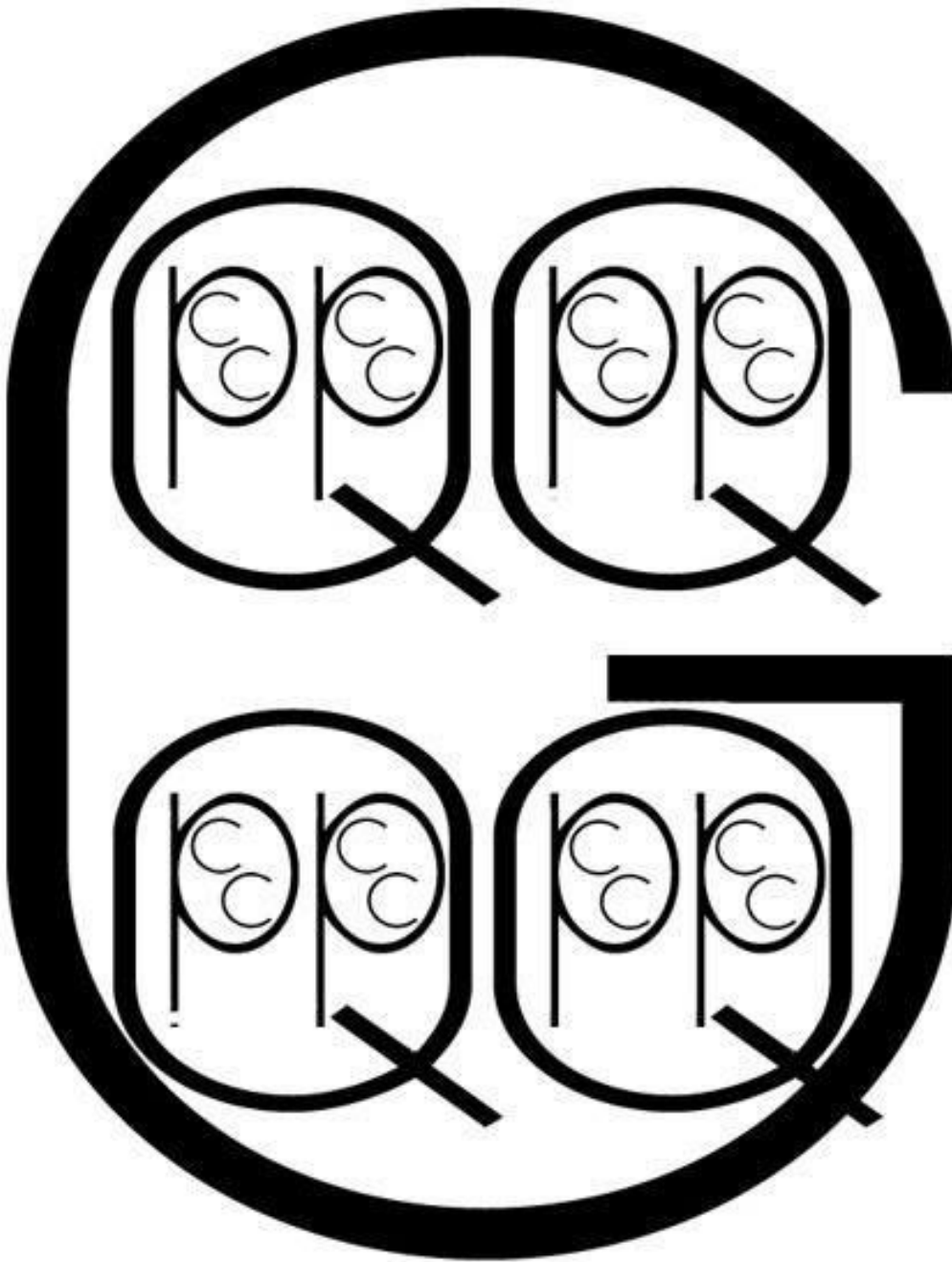


Image concept from: Math Principles for Food Service Occupations, 6<sup>th</sup> edition, page 99. The gallon image is credited to Professor Gary Brenenstuhl.

**Three teaspoons to a Tablespoon--Two Tablespoons to a fluid ounce**

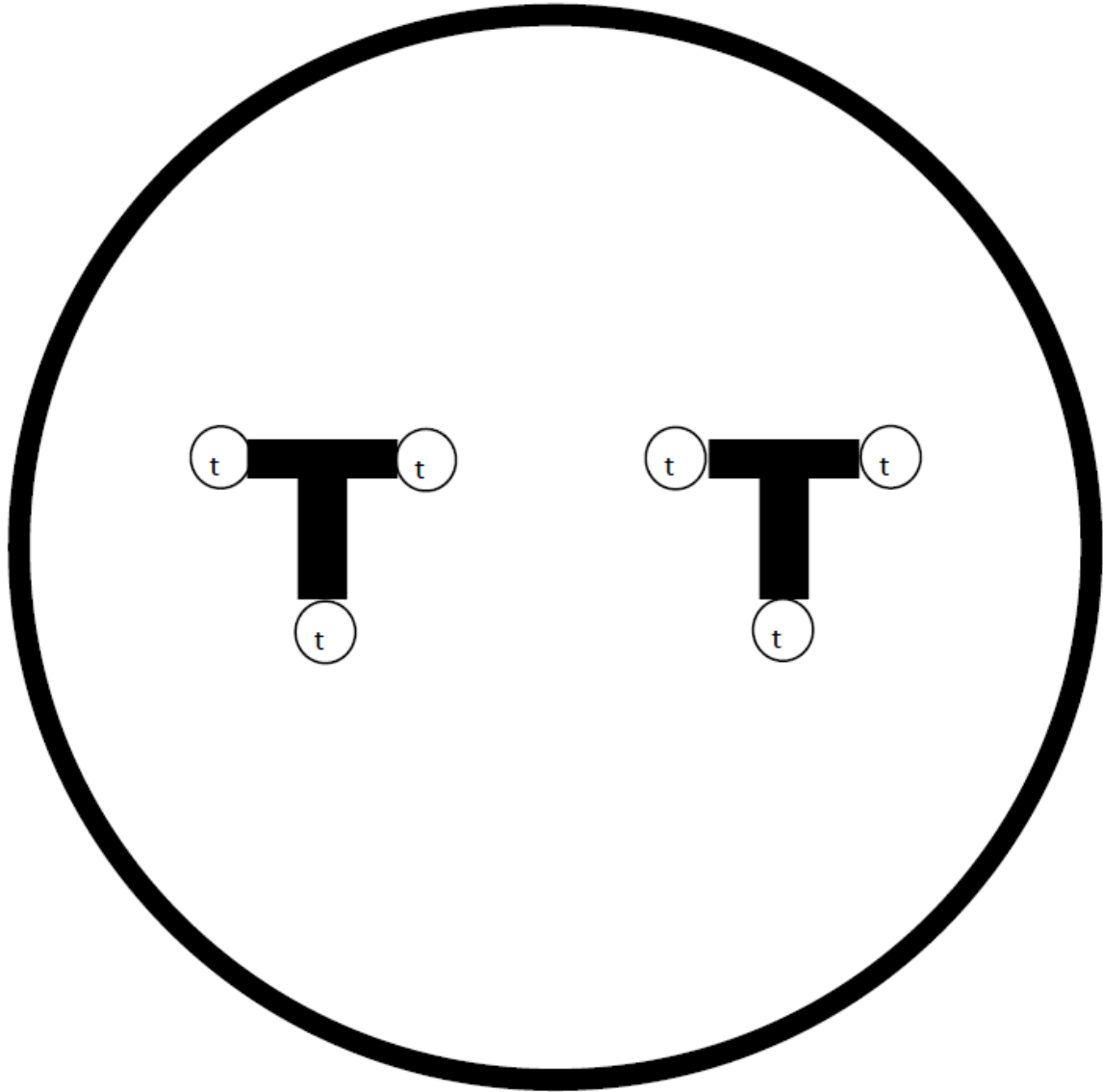


Image Concept Source: Math Principles for Food Service Occupations, 6<sup>th</sup> edition, page101. The Big Ounce to Kimberly Otis of Schenectady County Community College.

## Common Abbreviations and Symbols in Food Preparation

approx.	approximate
tsp or t	teaspoon
Tbsp or T	tablespoon
c	cup
fl. oz.	Fluid ounce
pt	pint
qt	quart
gal	gallon
wt	weight
oz	Ounce
lb or #	Pound (e.g., 3#)

## Volume Equivalents for Liquids

60 drops	1 tsp	
1 Tbsp	3 tsp	0.5 fl. Oz
1/8 cup	2 Tbsp	1 fl. Oz.
¼ cup	4 Tbsp	2 fl. Oz
1/3 cup	5 Tbsp +1 tsp	2.65 fl. Oz
3/8 cup	6 Tbsp	3 fl. Oz
½ cup	8 Tbsp	4 fl. Oz
5/8 cup	10 Tbsp	5 fl oz
2/3 cup	10 Tbsp +2 tsp	5.3 fl.oz
¾ cup	12 Tbsp	6 fl. Oz
7/8 cup	14 Tbsp	7 fl. Oz
1 cup	16 Tbsp	8 fl. Oz
½ pint	1 cup	8 fl oz
1 pint	2 cups	16 fl oz
1 quart	2 pt	32 fl. Oz
1 gallon	4 qt	128 fl oz